

# Bruneau/Grand View Nitrate Priority Areas

## Ground Water Quality Management Plan

May 2008



Idaho Department of Environmental Quality



Cover photograph: Duane Lafayette, Idaho Association of Soil Conservation Districts.

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## LIST OF ACRONYMS AND ABBREVIATIONS

AFO	animal feeding operation
BMP	best management practice
CAFO	confined animal feeding operation
DEQ	Idaho Department of Environmental Quality
EPA	U.S. Environmental Protection Agency
GWQP	Ground Water Quality Plan
IDAPA	Idaho Administrative Procedures Act
IDWR	Idaho Department of Water Resources
ISCC	Idaho Soil Conservation Commission
ISDA	Idaho State Department of Agriculture
IWM	irrigation water management
MCL	maximum contaminant level
mg/L	milligrams per liter
NMP	nutrient management plan
NPA	nitrate priority area
NRCS	Natural Resources Conservation Service
SWDH	Southwest District Health
TMDL	total maximum daily load
USGS	U.S. Geological Survey
WLAP	wastewater land application permit (permit for reclamation and reuse of municipal and industrial wastewater)

## EXECUTIVE SUMMARY

### Nitrate Contamination

The Idaho Department of Environmental Quality (DEQ), the Idaho Department of Water Resources (IDWR), the Idaho State Department of Agriculture (ISDA), and the United States Geological Survey (USGS) have determined that nitrate is a widespread, preventable ground water contaminant. In areas with vulnerable aquifers, nitrate from sources such as fertilizer, livestock manure, or septic waste can contaminate ground water and reach a water supply.

Nitrate contamination of ground water is of concern because over 95% of the drinking water consumed in Idaho is supplied by ground water. Strategies that eliminate or minimize nitrate contamination in the environment are critical because ground water is such a vital resource. Ground water monitoring in the Bruneau and Grand View areas has demonstrated elevated nitrate levels above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) for health concerns.

### Policy for Addressing Degraded Ground Water Quality Areas

In March 2000, DEQ established the Policy for Addressing Degraded Ground Water Quality Areas (Policy No. PM00-4, which is available on the DEQ Web site at <http://www.deq.idaho.gov/rules/policies/pm004.cfm>). One of the purposes of the policy is to set forth a process for DEQ to identify, designate, and delineate areas where ground water quality is significantly degraded as defined by rule (see the Idaho Ground Water Quality Rule at <http://adm.idaho.gov/adminrules/rules/idapa58/0111.pdf>). Another purpose of the policy is to identify the process for DEQ to facilitate and coordinate the development of management strategies with the use of local input for improving ground water quality in high priority areas, based on current nitrate priority area (NPA) categorization and applicable standards.

### Bruneau/Grand View Nitrate Priority Areas

The Bruneau/Grand View NPA is located in Owyhee County in southwestern Idaho. The area covers approximately 34,242 acres and includes the communities of Bruneau and Grand View. Technically, the Bruneau NPA is distinct from the Grand View NPA; however, because the two NPAs are geographically located near each other, are within the same county, and have similar land use, they have been grouped together for the purposes of this report and are referred to as the Bruneau/Grand View NPA.

Both NPAs have been placed on the DEQ nitrate priority list. Out of the 25 NPAs in the state, the Grand View NPA ranks sixth highest and the Bruneau NPA ranks fourteenth highest in terms of severity of ground water quality degradation from nitrate. More information regarding nitrate priority area ranking is available at [http://www.deq.idaho.gov/water/prog\\_issues/ground\\_water/nitrate.cfm#ranking](http://www.deq.idaho.gov/water/prog_issues/ground_water/nitrate.cfm#ranking).

## **Bruneau/Grand View Nitrate Priority Areas Ground Water Quality Management Plan**

Input from the public and various agencies was sought to develop strategies to improve ground water quality in the Bruneau/Grand View NPA; those strategies are presented in this ground water quality management plan.

The proposed strategies are focused on the following objectives:

- Educate the public about the health risks associated with drinking water with high nitrate and promote testing of individual wells for nitrate concentration.
- Educate the public about the sources of nitrate in ground water in order to promote prevention, protection, and remediation efforts that can maintain and improve water quality.
- Implement agricultural and residential best management practices (BMPs) to reduce nitrate loading to the ground water.

The strategies include specific actions for DEQ, ISDA, the Idaho Soil Conservation Commission (ISCC), Southwest District Health (SWDH), and IDWR to implement.

Presently, adoption of this plan is strictly voluntary. Ground water quality monitoring data collected by state agencies are compiled each year by DEQ, with the support of participating agencies. A more extensive review and evaluation of the effectiveness of the plan will be completed periodically as a joint effort among participating agencies. At each step, modifications to the plan will be discussed. If improvements to ground water nitrate concentrations are not realized, regulatory intervention may become necessary, per the Ground Water Quality Rule (IDAPA 58.01.11.400.03).

## INTRODUCTION

Ground water monitoring in the vicinity of the Bruneau and Grand View communities has demonstrated elevated nitrate levels above the U.S. Environmental Protection (EPA) maximum contaminant level (MCL) for health concerns. The Bruneau/Grand View nitrate priority area (NPA) is located in north-central Owyhee County along the Snake River in southwestern Idaho (Figure 1). The area covers approximately 34,242 acres or about 54 square miles and includes the communities of Bruneau and Grand View.

Technically, the Bruneau NPA is distinct from the Grand View NPA; however, because the two NPAs are geographically located near each other, are within the same county, and have similar land use, they have been grouped together for the purposes of this report and are referred to as the Bruneau/Grand View NPA. Both NPAs have been placed on the Idaho Department of Environmental Quality (DEQ) 2002 nitrate priority list. Out of the 25 NPAs in the state, the Grand View NPA ranks sixth highest and the Bruneau NPA ranks fourteenth highest in terms of the severity of ground water quality degradation from nitrate. Refer to Figure 2 for a map of the Bruneau/Grand View NPA.

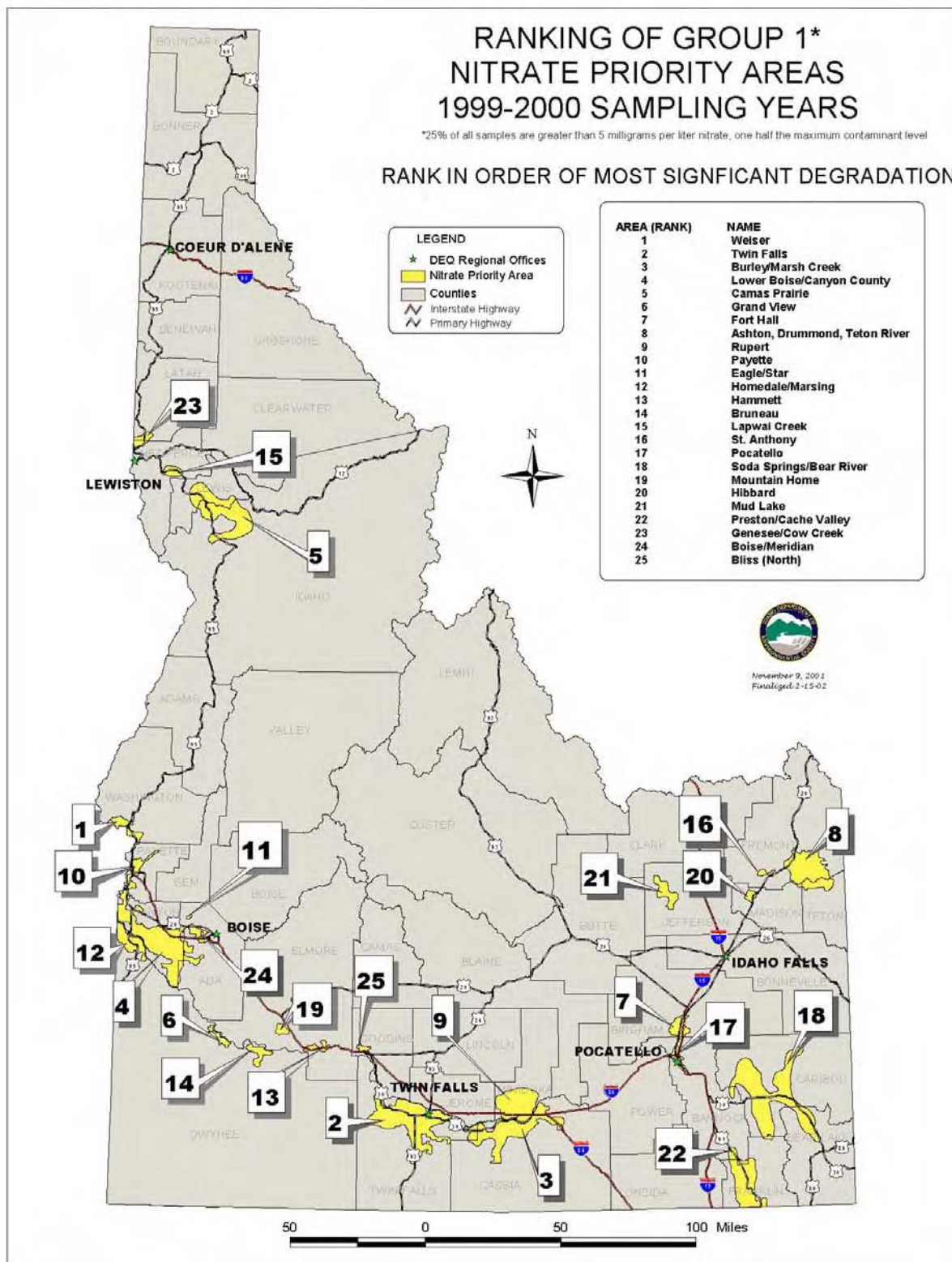


Figure 1. Map of 25 nitrate priority areas in Idaho identified in 2002. (Numbers 6 and 14 indicate the combined Bruneau/Grand View Nitrate Priority Area.)

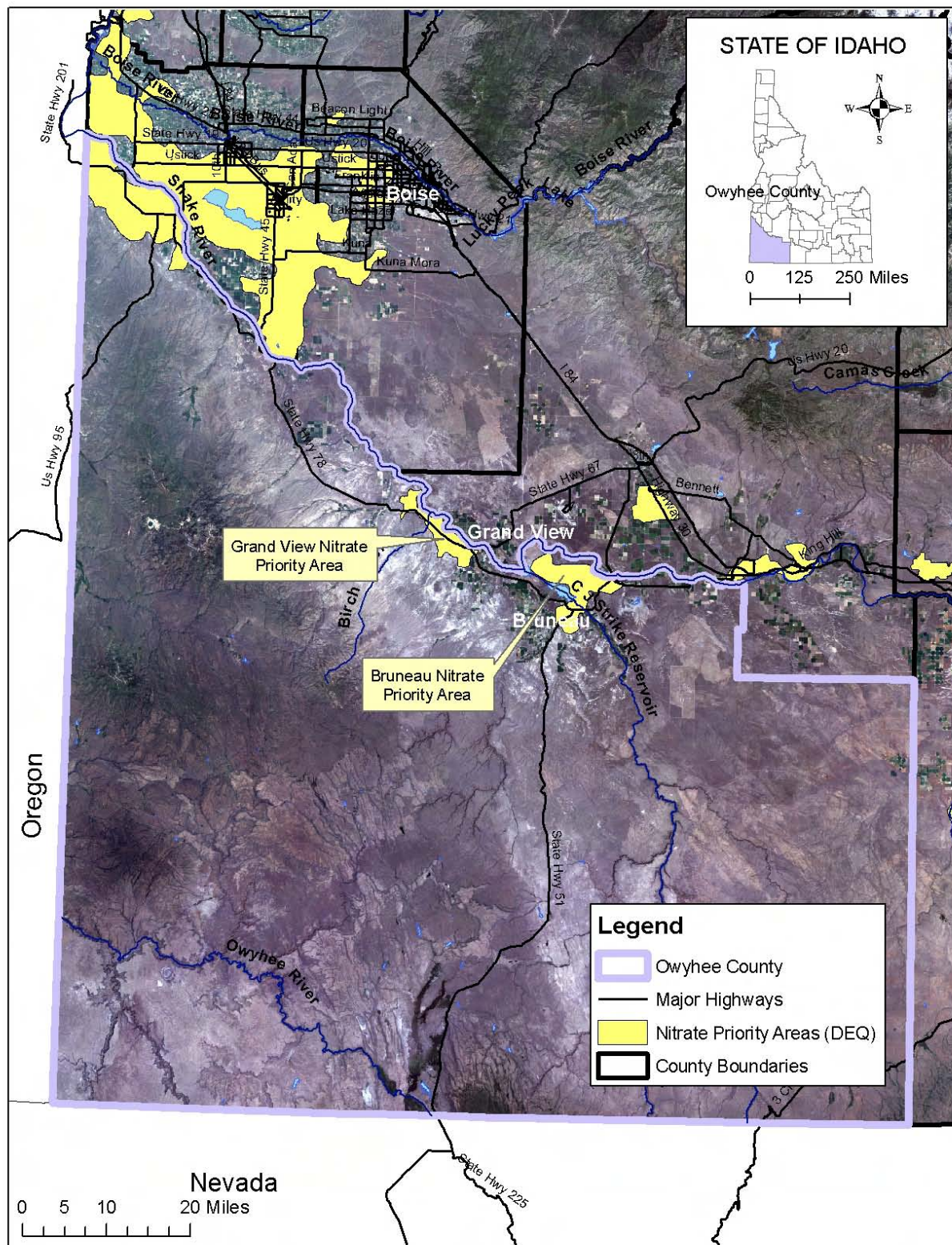


Figure 2. Southwest Idaho 2002 nitrate priority areas.

## **Nitrate as a Contaminant**

Nitrate is a form of nitrogen. Nitrogen is an element that is an essential nutrient for plant growth; its compounds are vital components of foods and fertilizers. Nitrate comes from a variety of sources, such as precipitation, septic sewer systems, plants, waste from animal feedlots, nitrogen-based fertilizers, and other organic matter that returns nitrate to the soil as it decomposes.

DEQ, the Idaho Department of Water Resources (IDWR), the Idaho State Department of Agriculture (ISDA), and the United States Geological Survey (USGS) have determined that nitrate is a widespread, preventable ground water contaminant related to land use or human activities. In areas with vulnerable aquifers, nitrate from sources such as fertilizer, livestock manure, or septic waste can contaminate ground water and reach a water supply.

Nitrate contamination of ground water is of concern because over 95% of the drinking water consumed in Idaho is supplied by ground water. Strategies that eliminate or minimize nitrate contamination in the environment are critical because ground water is such a vital resource.

### ***Maximum Contaminant Level***

EPA has established federal drinking water standards, called maximum contaminant levels (MCLs), for many contaminants; the MCL for nitrate is 10 milligrams per liter (mg/L). The Idaho ground water quality standard for nitrate in ground water is also 10 mg/L. Nitrate concentrations of 2 mg/L or greater generally indicate an anthropogenic (i.e., human-caused) impact to ground water.

People who rely on private wells for their drinking water supply are particularly at risk of exposure to high levels of nitrate. Private well owners are not required to test their water and may not be aware that a problem exists. Public water systems, however, are subject to regular testing by law, and nitrate levels must be below the federal health-based standard of 10 mg/L. Monitoring of the Grand View public water system has historically shown nitrate levels near the drinking water standard. However, a ground water quality evaluation conducted by DEQ in 2000 found nitrate in ground water (which is the source of the Grand View public water system's drinking water) locally at concentrations greater than the drinking water standard (DEQ, October 2000).

### ***Health Effects***

Elevated nitrate levels can pose a health problem for both humans and animals and can be an indicator of other water quality problems. The federal human drinking water standard of 10 mg/L is based on studies assessing the risk of developing methemoglobinemia (also known as blue baby syndrome) in infants as a result of exposure to nitrates.

Methemoglobinemia is the inability to absorb oxygen in the blood system. Nitrate levels above the regulatory level have been associated with methemoglobinemia. The condition is usually associated with newborns and infants up to 6 months of age and occurs when nitrate is converted to nitrite in a child's body. Nitrite reduces oxygen in the child's blood, causing shortness of breath and blueness of skin. This condition can be serious, causing the child's health to deteriorate rapidly over a period of days.

Other populations potentially vulnerable to methemoglobinemia include pregnant women, adults with reduced stomach acidity, adults who lack a hereditary enzyme needed to combat effects of nitrate in their body, and dialysis patients.

High-nitrate water is generally a health hazard to animals only when used with high-nitrate feed. Short-term use of water with up to 40 mg/L nitrate is generally considered acceptable for animals.

### ***Nitrate in Ground Water***

Nitrate is soluble in water and can easily pass through soil to the ground water, which is the major source of drinking water in the Bruneau/Grand View area. Nitrate can persist in ground water for decades and accumulate at high levels as more nitrogen is added to the soil every year and leaches into the ground water. High levels of nitrate in soil, ground water, and drinking water can originate from the application of nitrogen in the form of commercial fertilizer and animal waste, legume crop plow-down, and septic tank failures. Shallow wells, wells in sandy soil, or wells that are improperly constructed or maintained are more likely to have nitrate contamination than deeper wells with protective casing and an effective well seal.

Nitrate is often an indicator of aquifer vulnerability, with the presence of higher concentrations of nitrate in ground water associated with certain land use activities. Whenever nitrogen-containing compounds come into contact with soil, a potential for nitrate leaching into ground water exists. Nitrate is highly soluble and will stay in solution in percolation water after leaving the root zone, until it reaches ground water.

### **Nitrate Area Prioritization Process**

In March 2000, DEQ established the Policy for Addressing Degraded Ground Water Quality Areas (Policy No. PM00-4, which is available on the DEQ Web site at <http://www.deq.idaho.gov/rules/policies/pm004.cfm>). Pursuant to guidance provided in the policy, a statewide list of significantly degraded areas for nitrate was developed, because nitrate is one of the most widespread ground water contaminants in Idaho. (More information is available at [http://www.deq.idaho.gov/water/prog\\_issues/ground\\_water/nitrate.cfm#ranking](http://www.deq.idaho.gov/water/prog_issues/ground_water/nitrate.cfm#ranking).)

DEQ, with assistance from IDWR, ISDA, USGS, and other agencies, delineated nitrate-degraded ground water areas using ground water quality monitoring analytical results from various agencies combined with hydrogeologic and land use data. If 25% of the ground water samples in a hydrogeologically similar area were greater than or equal to one-half the federal drinking water standard for nitrate (5 mg/L), the area was delineated as an NPA.

In 2000, ground water in 25 areas of Idaho met the criteria for classification as degraded by nitrate (Figure 1). These areas were then prioritized using three weighted principal criteria: population, existing water quality, and water quality trends. The area surrounding Grand View ranked sixth on the list, and the area surrounding Bruneau ranked fourteenth (Figure 2). These rankings are used to prioritize the development and implementation of strategies to help reduce nitrate contamination in ground water from land-use activities.

## **Bruneau/Grand View Nitrate Priority Area Ground Water Quality Management Plan**

This ground water quality management plan was prepared to address the Bruneau and Grand View areas, with the intent of educating the public on methods to improve existing ground water conditions and prevent additional nitrate degradation.

To address nitrate contamination in the Bruneau and Grand View NPAs, three public meetings were held from October to December 2006 in Grand View, Idaho. The meetings were designed to present information to the local residents about nitrate contamination, existing programs and activities, and to solicit ideas and recommendations for additional actions that could be taken to reduce the concentration of nitrate in ground water. The agencies that participated in this effort include DEQ, ISDA, the Idaho Soil Conservation Commission (ISCC), IDWR, and Southwest District Health (SWDH). The strategies and action items identified for the Bruneau and Grand View areas are included in this plan and focus on prevention, protection, and remediation measures to maintain or improve water quality.

Presently, adoption of this plan is strictly voluntary. The intent of this plan is to encourage voluntary implementation of best management practices (BMPs), including modifying operations management, to reduce nitrate loading to ground water. Ground water monitoring data collected by state agencies are compiled each year by DEQ, with the support of participating agencies. A more extensive review and evaluation of the effectiveness of the plan will be completed periodically as a joint effort among participating agencies. At each step, modifications to the plan will be discussed. If improvements to ground water nitrate concentrations are not realized, regulatory intervention may become necessary, per the Ground Water Quality Rule (IDAPA 58.01.11.400.03).

## **Responsibilities and Authorities**

### ***Idaho Code and the Ground Water Quality Plan***

DEQ is designated as the primary agency to coordinate and administer ground water quality protection programs for the state (Ground Water Quality Protection Act of 1989, Idaho Code 39-120). Idaho Code 39-120 is available at <http://www3.state.id.us/cgi-bin/newidst?sctid=390010020.K>. The Ground Water Quality Protection Act authorized development of the Ground Water Quality Plan (GWQP) by the Ground Water Quality Council. The GWQP was adopted by the Idaho Legislature in 1992 and was amended in 1996. Various state and local agencies have responsibilities for and are involved in implementing the GWQP. The GWQP is available on the DEQ Web site at [http://www.deq.idaho.gov/water/data\\_reports/ground\\_water/reports.cfm#gw\\_plan](http://www.deq.idaho.gov/water/data_reports/ground_water/reports.cfm#gw_plan).

As the primary agency for ground water quality protection, DEQ chairs the Ground Water Monitoring Technical Committee. This committee meets periodically throughout the year to coordinate monitoring projects and share results. The committee includes representatives from other Idaho state agencies (e.g., IDWR, ISDA, and ISCC), Idaho Health Districts, the Idaho Water Resources Research Institute, Idaho's universities, and federal agencies (e.g., USGS).

Idaho Code Title 39, Chapter 1 (Environmental Quality – Health) states, “Cities, counties and other political subdivisions of the state shall incorporate the ground water quality protection plan in their programs and are also authorized and encouraged to implement ground water quality protection policies within their respective jurisdictions...” (§39-126). Title 39-126 is available on the Internet at <http://www3.state.id.us/cgi-bin/newidst?sctid=390010026.K>.

According to Idaho Code Title 67, Chapter 65 (Local Land Use Planning), when considering amending, repealing, or adopting a comprehensive plan, the local governing board shall consider the effect the proposed amendment, repeal, or adoption of the comprehensive plan would have on the source, quantity and quality of ground water in the area (§67-6537). Title 67-6537 is available on the Internet at <http://www3.state.id.us/cgi-bin/newidst?sctid=670650037.K>.

### ***Idaho Ground Water Quality Rule***

The Ground Water Quality Rule (IDAPA 58.01.11.400.02 and IDAPA 58.01.11.400.03) (see <http://adm.idaho.gov/adminrules/rules/idapa58/0111.pdf>) sets forth a number of alternative actions that DEQ may follow when a numerical ground water quality standard has been exceeded, as well as when no standard has been exceeded but significant degradation of ground water has been detected. The ground water quality standard addressed in this plan is the primary (health-based) drinking water standard for nitrate of 10 mg/L.

### ***Policy for Addressing Degraded Ground Water Quality Areas***

In March 2000, DEQ established the Policy for Addressing Degraded Ground Water Quality Areas (Policy No. PM00-4, which is available on the DEQ Web site at <http://www.deq.idaho.gov/rules/policies/pm004.cfm>). One of the purposes of the policy is to set forth a process for DEQ to identify, designate, and delineate areas where ground water quality is significantly degraded as defined by rule (see the Idaho Ground Water Quality Rule at <http://adm.idaho.gov/adminrules/rules/idapa58/0111.pdf>). Another purpose of the policy is to identify the process for DEQ to develop management strategies with the use of local input for improving ground water quality in high priority areas, based on current NPA categorization and applicable standards. DEQ’s main role is facilitation and coordination for the development of site-specific ground water quality management plans.

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## LOCAL NITRATE CONTAMINATION

### Local Ground Water Quality

The map in Figure 3 shows the boundaries of the Bruneau and Grand View NPAs designated in 2002. The ground water sampling sites are color-coded by nitrate concentration, with red indicating samples exceeding the drinking water standard of 10 mg/L. Yellow indicates nitrate concentrations ranging from 5.00–9.99 mg/L. Symbols represent the various sources of analytical results. ISDA sample sites are shown as circles, public water systems as triangles, and remaining agency sampling sites are shown as squares. Private domestic, public, and irrigation wells were used as sampling sites.

It is important to note when reviewing the map that wells intercept water at varying depths below the water table and, in general, the highest concentrations of nitrate are present in the shallowest water-bearing zones.

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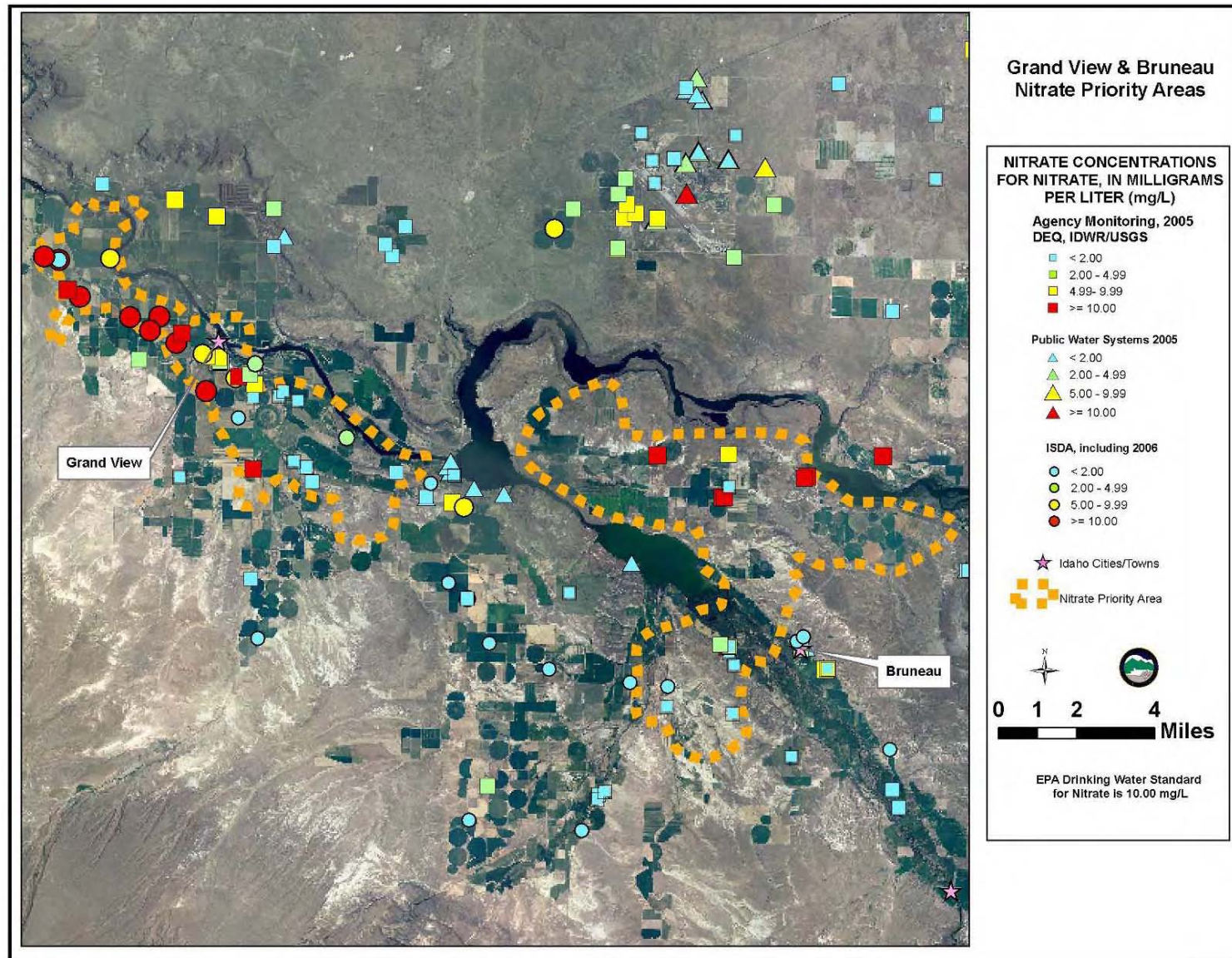


Figure 3. Bruneau and Grand View Nitrate Priority Areas.

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### Local Nitrogen Budget

A nitrate budget was developed for potential sources of nitrogen (referred to as loads) that may impact water resources—especially ground water resources—within the Bruneau/Grand View area. A description of how the nitrate budget was developed is included in Appendix A, and the results are displayed in Figure 4 below. The largest potential source of nitrogen that could impact ground water in the Bruneau/Grand View area is nitrogen from fertilizer applications (65.2%). The next largest potential sources of nitrogen are legume crop plow-down (16.6%) and dairy and beef cattle (16.4%). The remaining 1.7% of the potential nitrogen sources can be attributed to domestic/urban waste (0.9%) and precipitation sources (0.8%).

Although the greatest potential for nitrogen loading to soil in the Bruneau and Grand View areas comes from commercial fertilizers, legume plow-down, and livestock operations, it is important to note that problems can also occur locally from smaller sources.

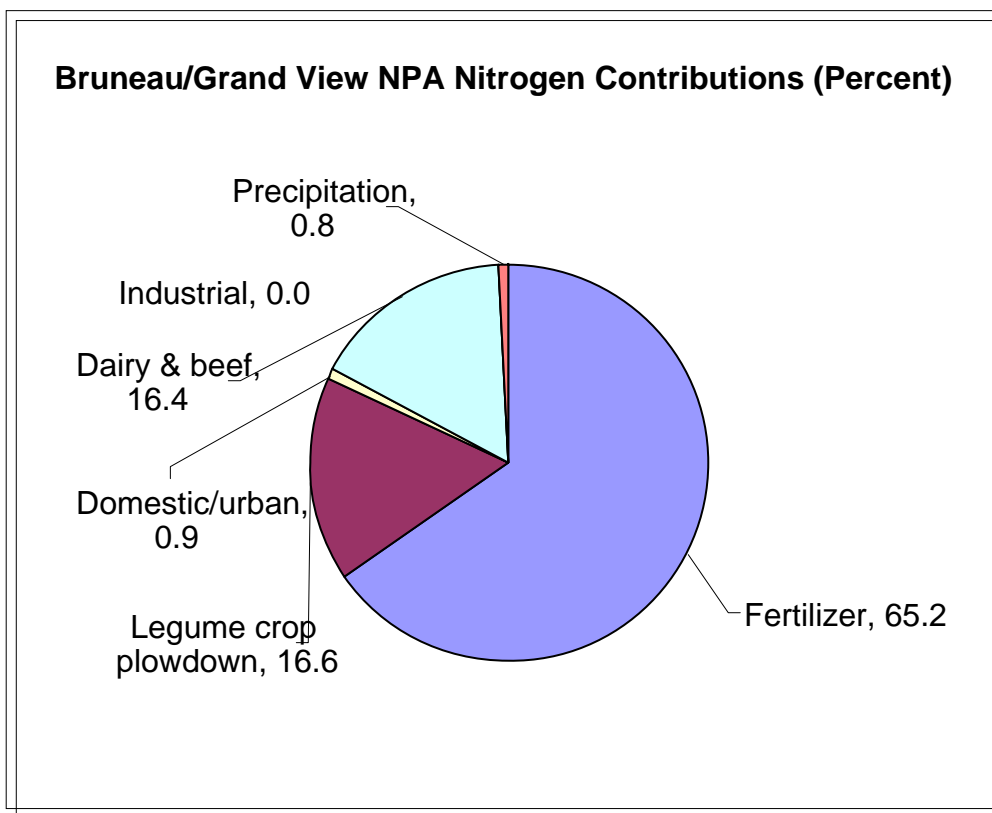


Figure 4. Potential nitrogen contributions (percent) to water resources in the Bruneau/Grand View NPAs.

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## MANAGEMENT PLAN

### Goals and Objectives

The goals of this ground water quality management plan are to 1) reduce the contamination of nitrate in the Bruneau and Grand View NPAs so public health is protected and 2) remove the Grand View and Bruneau NPAs from the statewide nitrate priority list. The proposed objectives to achieve these goals are as follows:

- Educate the public about the health risks associated with drinking water with high nitrate and promote testing of individual wells for nitrate concentration.
- Educate the public about the sources of nitrate in ground water in order to promote prevention, protection, and remediation efforts that can maintain and improve water quality.
- Implement agricultural and residential BMPs to reduce nitrate loading of the ground water, thereby improving ground water quality.

### Strategies for Implementation

DEQ, IDWR, ISDA, ISCC, SWDH, and the public identified the following general strategies to protect public health and reduce nitrate contributions to ground water in the Bruneau/Grand View NPA:

- Protect wellheads by providing information to private well owners on setbacks for activities with the potential to contribute contaminants to ground water (e.g., septic systems; fertilizer storage, handling, and cleanup; livestock facilities; manure storage and silos).
- Encourage private wells owners to regularly test their well water.
- Reduce nitrate contributions from septic systems by promoting maintenance.
- Control runoff and infiltration from livestock facilities by enforcing existing regulations and providing education, training, and incentives to producers to control animal waste.
- Encourage private landowners through education, training, and incentives to properly store and apply animal waste at agronomic rates.
- Encourage consideration of all nitrogen sources in determining proper nitrogen-based fertilizer application rates to crops and recommend all applicators test soil in fields to help determine appropriate application rates. Other sources of nitrogen include legume crop plow-down, applied organic material (e.g., manure), residual nitrate in the soil, and nitrogen in irrigation water.

Table 1 summarizes the action items needed to maintain or improve ground water quality in the Bruneau/Grand View NPA. The table is organized by implementing agency and includes general timeframes for the completion of each item.

**Table 1. Implementation tasks for the Bruneau/Grand View NPA Ground Water Quality Management Plan.**

<b>Action Item</b>	<b>Time Frame</b>
<b><i>Idaho Department of Environmental Quality</i></b>	
<b>Facilitation and Reporting</b>	
Facilitate annual meeting of participating agencies and the public to review monitoring data, action item status, and the need for plan modification.	Fourth quarter of each year
Provide plan status updates to distribute at Ground Water Technical Committee meetings.	As necessary
Provide plan status updates to distribute at Interagency Ground Water Protection Committee meetings (see the Idaho Ground Water Protection Interagency Cooperative Agreement).	As necessary
Post summary reports and revised plan on DEQ Web site.	As necessary
<b>General Information and Education</b>	
Provide copies of the final plan and any future updates to local decision makers, including Owyhee County Commissioners, Grand View City Council members, and Bruneau River Soil Conservation District board members. Post plan and revisions to internet (DEQ Web site).	As needed
Provide copies of the plan to the public, upon request. Plan will be available to public via the internet (DEQ Web site).	As requested
<b>Grant Oversight</b>	
Award and oversee \$319 Grant project funding.	Annually
<b>Public Drinking Water Systems</b>	
Review and approve all new public water supply engineering design reports.	As needed
Prepare Source Water Assessments for all new public water system wells.	As needed
Help develop, review, and certify Drinking Water Protection Plans for public water systems.	As requested
Require and review public water system monitoring data to confirm that drinking water meets all state and federal maximum contaminant levels (MCLs).	Frequencies vary
<b>Monitoring</b>	
Compile regional water quality data. With input from other agencies and the public, adjust boundaries of NPA as appropriate.	2008; every 5 years thereafter
Conduct coordinated ground water monitoring as deemed necessary to better characterize nitrate contamination, determine nitrate concentration trends, identify the vertical extent of contamination, and/or identify the presence of nitrate contamination outside of the NPA boundaries.	Regularly
Within a regional context, assess whether a ground water monitoring project is warranted and whether funding is available.	Second quarter of each year
<b><i>Southwest District Health Department</i></b>	
<b>Septic Systems</b>	
Provide information about treatment system options and septic system maintenance at public locations in Bruneau and Grand View, and at the Owyhee County Courthouse.	Ongoing
Continue with the permitting of all new, expanded, and replacement septic systems.	As requested
Inspect existing septic systems when new homes or home extensions are added.	As needed

Action Item	Time Frame
<b>Private Water Supply Wells and Public Health</b>	
Provide information regarding the responsibilities of being a private well owner/user at public locations in Bruneau and Grand View and at Owyhee County offices. Include information and resources for understanding proper well location with respect to potential sources of contamination, installation procedures, and wellhead maintenance.	Ongoing
Provide information at public locations in Bruneau and Grand View and at Owyhee County offices about the health affects of nitrate.	Ongoing
Promote regular testing of private wells and provide drinking water treatment options.	Ongoing
Provide sample bottles and information about analytical laboratories.	As requested
<b><i>Idaho Association of Soil Conservation Districts, Idaho Soil Conservation Commission, Bruneau River Soil Conservation District</i></b>	
<b>Public Awareness, Education, and Outreach</b>	
Prepare an Information and Education (I&E) Plan that includes timelines, public service announcements (PSAs), brochures, mailings, demos, tours, etc.	2008
Contact producers to inform them of the following: <ul style="list-style-type: none"> <li>• water quality goals and objectives of projects implemented</li> <li>• potential agricultural impacts of nitrate contamination to ground water quality</li> <li>• nutrient management benefits</li> <li>• irrigation water management (IWM) benefits</li> <li>• details of incentive programs</li> <li>• I &amp; E programs</li> </ul>	Ongoing
Conduct irrigation water management outreach: <ul style="list-style-type: none"> <li>• conduct irrigation workshops</li> <li>• make soil moisture monitoring equipment available to producers interested in optimizing irrigation applications</li> <li>• encourage sprinkler irrigators to take advantage of Idaho Power Energy Efficiency in Irrigation Program</li> </ul>	Ongoing
Identify additional high priority landowners, then educate them about the benefits of implementing nutrient management planning (NMP)/IWM, using data and outputs compiled over the course of the project.	Ongoing
<b>Best Management Practices- Program Planning</b>	
Submit a §319 Clean Water Act Grant Application to fund BMP implementation.	First quarter of 2008
Establish a steering committee of Bruneau River Soil Conservation District members and staff from IASCD, ISCC, DEQ, ISDA, and the Natural Resources Conservation Service (NRCS) to develop a project plan that will include the following: <ul style="list-style-type: none"> <li>• criteria for prioritizing activities in the NPA for NMP, IWM, and total maximum daily loads [TMDLs]</li> <li>• contracting procedures for nutrient management planning</li> <li>• estimating incentives to be offered and methods of distribution</li> <li>• monitoring and evaluation of BMP effectiveness</li> <li>• information and education outreach options and methods to be utilized</li> </ul>	When funding is secured (which is not likely until May 2009) <sup>1</sup>

<sup>1</sup> The general schedule is: April 2008—projects presented to Basin Advisory Group, June 2008—statewide ranking of §319 projects, April 2009—anticipated notification of project funding.

Action Item	Time Frame
<b>NMP, IWM and BMP Implementation and Evaluation</b>	
Implement NMPs: <ul style="list-style-type: none"> <li>Identify high priority or critical areas to focus on</li> <li>Review ISDA and other agency water quality monitoring reports and data</li> <li>Contact critical landowners</li> <li>Develop and conduct NMPs</li> <li>Follow-up with producers to review and evaluate NMPs</li> <li>Compile general (non-producer-specific) information in report to DEQ</li> </ul>	
IWM Evaluations: <ul style="list-style-type: none"> <li>Identify fields to evaluate</li> <li>Install soil moisture equipment</li> <li>Analyze data</li> <li>Report findings to producers</li> <li>Compile general (non-producer-specific) information in report to DEQ</li> </ul>	
Implement BMP Effectiveness Evaluation Program: <ul style="list-style-type: none"> <li>Analyze soil sampling data/fertilizer receipts to determine whether NMPs have been properly followed</li> <li>Analyze soil moisture sensor data to evaluate irrigation management recommendations</li> <li>Review ground water quality results for samples collected by ISDA within the Bruneau/Grandview NPA</li> </ul>	Fourth quarter of each year.
<b>Perform Biannual Reviews and Prepare \$319 Grant Report for DEQ</b>	
Conduct status review with each participant	Annually
Prepare report with general information about activities and results conducted and submit to DEQ in a time frame to coincide with the invoice period (as required by DEQ).	As required
<b><i>Idaho State Department of Agriculture</i></b>	
<b>Education and Outreach</b>	
Through the Agriculture Ground Water Coordination Committee, complete the following: <ul style="list-style-type: none"> <li>Request that University of Idaho fertilizer application guides be reviewed and updated as needed</li> <li>Promote education/outreach regarding potential sources</li> <li>Encourage voluntary implementation of BMPs</li> </ul>	Ongoing
<b>Water Supply Wells</b>	
Promote use of Home*A*Syst as a tool to assess and change homeowner and farmstead activities that have the potential to contaminate drinking water wells.	Ongoing
<b>Livestock Facility Waste Management</b>	
Continue to require NMPs at every licensed dairy and regulated animal feeding operation (AFO) to help control runoff and infiltration of animal waste.	Ongoing
Identify all confined cattle feeding operations that could be considered significant contributors of contaminants to waters of the state and work with the operators to properly manage waste and develop NMPs for their facilities.	Ongoing

Action Item	Time Frame
<b>Manure Storage and Application</b>	
Continue to aid owners/operators in developing the required manure storage and application procedures in livestock facility NMPs.	Ongoing
Provide information/training to private landowners who accept manure from animal feed lots for use as fertilizer. This task will include the following subtasks: <ul style="list-style-type: none"> <li>• identify target audience</li> <li>• create informational brochures/flyers or pamphlets as guidance for proper storage and application methods</li> <li>• in coordination with the University of Idaho Extension and other interested groups, develop seminar/presentation materials for workshops</li> <li>• disseminate information to the target audience through mailings, workshops, or other means, as appropriate</li> </ul>	2008
<b>Monitoring</b>	
Conduct ground water monitoring to characterize nitrate contamination, determine nitrate concentration trends, and identify the presence of nitrate contamination outside of the NPA boundaries, as deemed necessary: <ul style="list-style-type: none"> <li>• compile and update all monitoring data in the region</li> <li>• compile available well construction information to better characterize vertical distribution of contaminants</li> <li>• identify data gaps and develop and obtain funding for monitoring project, if warranted</li> <li>• conduct monitoring and prepare reports</li> <li>• provide presentations and updates to the Bruneau Soil and Water Conservation District and the public</li> </ul>	Ongoing
Conduct ground water quality monitoring and BMP effectiveness monitoring evaluation associated with BMP implementation projects.	As required
<b><i>Idaho Department of Water Resources</i></b>	
<b>Information and Education</b>	
Using the well permitting process, distribute information to homeowners through well drillers about the potential presence of nitrate contamination in drinking water supplies.	Ongoing
<b>Monitoring</b>	
Through the Statewide Ambient Ground Water Quality Monitoring Program, conduct ground water monitoring to better characterize nitrate contamination, determine nitrate concentration trends, and identify the presence of nitrate contamination inside and outside the NPA boundaries.	Ongoing
<b><i>Confined Animal Feeding Operation (CAFO) Site Advisory Team</i></b>	
The ISDA (as team lead of Idaho's CAFO Site Advisory Team), DEQ, and IDWR will continue to review sites proposed for CAFOs, determine environmental risks, and submit site suitability determinations to counties.	Ongoing

## Plan Evaluation

The goals of this plan are to 1) reduce the contamination of nitrate in the Grand View and Bruneau NPAs so public health is protected and 2) remove these areas from the statewide nitrate priority list. However, due to the slow nature of ground water movement, it is not anticipated that quantitative reductions in nitrate levels will occur during the early implementation stages of the plan. Therefore, qualitative measures will be used to evaluate the progress and success of the plan in the short term (3-5 years). Once the plan is being implemented, the following activities will occur to evaluate the progress made in reducing nitrate contamination of the ground water:

- DEQ will facilitate an annual meeting of the participating agencies and advisory committee, including the public, to review the status of implementation activities that have occurred and evaluate available monitoring results.
- The participating agencies and advisory committee will evaluate the effectiveness of the plan and modify it as needed.

A compilation of findings from federal, state, and local agencies will be made each year. DEQ, with the support of the participating agencies, will be the lead entity to compile this information. The first review is scheduled for 2009. The qualitative evaluation will assess whether the appropriate institutions promoted the plan recommendations and will include documentation of activities, practices, and alternatives adopted to reduce nitrate loading to the ground water. This evaluation will also consider whether the protection strategies are still being promoted and what percentage of citizens, businesses, and other organizations are participating in the plan.

A longer-term interval evaluation will be performed on a five-year schedule to document the trend of nitrate levels following implementation of the plan. The ISDA (Ground Water Program) and IDWR/USGS (Statewide Ambient Ground Water Quality Monitoring Program) will continue to sample for nitrate on a regular basis. DEQ will assist with or will conduct follow-up activities that may include monitoring in response to detections of concern (i.e., high nitrate) in public water systems or in response to ground water sampling activities conducted by other agencies. The determination of the success of this management plan will depend on the results of ongoing trend analyses based on statistical analysis of monitoring results from the state monitoring networks. These activities will be a joint effort between DEQ, ISDA, ISCC, SWDH, and IDWR.

At each step, DEQ and the participating agencies will determine whether this management plan is addressing the ground water contamination concerns adequately or whether the plan needs modified to better enable success.

## REFERENCES

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- Ground Water Quality Council. December 1996. Idaho Ground Water Quality Plan [http://www.deq.idaho.gov/water/data\\_reports/ground\\_water/reports.cfm#gw\\_plan](http://www.deq.idaho.gov/water/data_reports/ground_water/reports.cfm#gw_plan)
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## GLOSSARY

**Agricultural activity/agriculture** – Any activity conducted on land or water for the purpose of producing an agricultural commodity, including crops, livestock, trees, and fish.

**Ambient** – The best-assumed level of water quality prior to human land use activities.

**Animal feeding operation (AFO)** – The holding of any number of animals in buildings, pens, or lots.

**Aquifer** – A geological formation of permeable saturated material, such as rock, sand, gravel, etc., capable of yielding economically significant quantities of water to wells and springs.

**Best management practice (BMP)** – A practice or combination of practices determined to be the most effective and practical means of preventing or reducing contamination to ground water and/or surface water from nonpoint and point sources in order to achieve water quality goals and protect the beneficial uses of the water.

**Contaminant** – Any chemical, ion, radionuclide, synthetic organic compound, microorganism, waste, or other substance that does not occur naturally in ground water, or a constituent that occurs naturally that may cause health concerns.

**Degradation** – When a numerical ground water quality standard has been exceeded.

**Effluent, solid or liquid** – Any waste material moving away from its point of origin.

**Fertilizer** – Any substance containing one or more plant nutrients utilized to enhance plant nutrient content and/or for promoting plant growth.

**Ground water** – Any water that occurs beneath the surface of the earth in a saturated geological formation of rock or soil.

**Ground water quality standards** – Values, either numeric or narrative, assigned to any contaminant for the purpose of establishing maximum levels or protection. Ground water quality standards are a portion of the Idaho Ground Water Quality Rule (IDAPA 58.01.11).

**Infiltration rate** – The rate at which water infiltrates or seeps into the soil.

**Irrigation water management** – Determining and controlling the rate, amount, and timing of irrigation water in a planned and efficient manner.

**Leach** – To dissolve nitrogen (or other constituents) into water, potentially enabling these constituents to reach the ground water.

**Legume** – Crops having nodules on the roots containing bacteria that are able to convert nitrogen in the air into a usable form for the plant.

**Livestock wastes** – A term sometimes applied to manure that may also contain bedding, spilled feed, water, or soil. It also includes wastes not particularly associated with manure, such as milking center or washing wastes, milk, hair, feathers, or other debris.

**Local government** – Cities, counties, and other political entities of the state.

**Manure** – The fecal and urinary excretions of livestock and poultry.

**Maximum contaminant level (MCL)** – The maximum level at which a contaminant is considered safe for human health as determined by the U.S. Environmental Protection Agency.

**Milligrams per liter (mg/L)** – The weight of a substance measured in milligrams contained in one liter.

**Mineralization** – Increases in concentration of one or more inorganic constituents resulting from contact of ground water with geologic formations.

**Nitrate** – A common contaminant identified in ground water. Nitrate is a component in fertilizer, is found in wastes at the soil surface, and occurs naturally in the soil through a process such as mineralization of organic nitrogen. The MCL for nitrate is 10 mg/L.

**Nitrogen-fixing crop** – A crop that is able to take nitrogen from the air and convey it to microorganisms in soil for consumption.

**Nonpoint source** – A contaminant or pollutant released in a diffuse manner of entry into a water body so there is no identifiable or specific point of entry.

**Nutrient** – Any substance applied to the land surface or to plants that is intended to improve germination, growth, yield, product quality, reproduction, or other desirable characteristics of plants.

**Nutrient management** – Managing the amount, form, placement, and timing of plant nutrient applications.

**Nutrient management plan** – A plan for managing the amount, placement, form, and timing of the land application of nutrients and soil amendments.

**Nutrient-pathogen evaluation** – A scientifically-based comprehensive site evaluation of soils, geologic conditions, and hydrology in an area to evaluate potential impacts to ground and surface waters from effluent of on-site wastewater treatment systems.

**Organic matter** – Substances of biological origin that contain carbon-decaying cells of plants, microorganisms, or small animals.

**Organic nitrogen** – A form unavailable to plants until the mineralization process takes place. Most of this type of nitrogen is bonded to carbon in living and decaying cells of plants, microorganisms, or small animals.

**Point source** – A contaminant or pollutant, often released in concentrated form, from a conveyance system or discrete source, such as from a pipe, into a body of water.

**Process water** – Water used in a facility or an AFO that cleans equipment, the facility, or animals.

**Public water system** – Serves at least 15 service connections used by year-round residents or regularly serves a population of at least 25 year-round residents.

**Residual nitrogen/nutrients** – Residual or unused nitrogen remaining in the soil after a crop is harvested.

**Root zone** – The zone within a soil profile where roots predominate, normally at 0-9 inches of soil depth.

**Soil profile** – A vertical section of soil delineating the distinct horizontal layers of various soils and geologic formations in a given area.

**Total maximum daily load (TMDL)** – Determination of a water body's capacity to support beneficial uses.

**Wastewater** – Process water after use within a facility or AFO; the water is usually treated prior to disposal.

**Water quality** – The excellence of water in comparison with its intended use or uses.

**Wellhead** – The physical structure, facility, or device at the land surface from or through which ground water flows or is pumped from subsurface water-bearing formations.

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## **APPENDIX A. Nitrogen Loading Evaluation for the Bruneau and Grand View Nitrate Priority Areas, Owyhee County, Idaho**

Developed by the Idaho Department of Environmental Quality

**August 2006**

## PURPOSE

The purpose of this report is to present an evaluation and summary of the potential sources of nitrogen (referred to as loads) that may impact water resources—especially ground water resources—within the boundaries of Owyhee County.

## SPECIFIC OBJECTIVES

The objectives of the nitrogen loading evaluation include the following:

- Obtain data on crops grown in the county and estimate, where practical, the nitrogen requirement for the major crops for the most recent year of record.
- Estimate the amount of nitrogen that may be released when legume crops are plowed under.
- Obtain census data for the county and estimate the potential nitrogen loading from domestic wastewater treatment systems.
- Obtain livestock data for the county and estimate the potential nitrogen loading from animal wastes.
- Estimate the nitrogen loading from any permitted industrial wastewater land application sites in the county.
- Estimate nitrogen loading to the hydrologic cycle from atmospheric contributions in the form of precipitation for the county.
- Estimate nitrogen loading from the sources noted above, where feasible, in the area from Sinker Creek east to the county line which encompasses the nitrate priority areas.

## LIMITATIONS OF THE DATA USED IN THE EVALUATION

The following limitations apply to the data used in this evaluation of nitrogen loading:

- Some subtotals and totals are rounded. Therefore, the sum of individual values in the text will not always add up to the values in the tables.
- Data sources span the time frame of 2005 to 2006, but data for all of the objectives listed above were not always available for the same year for all of the sources of nitrogen tabulated in this evaluation. The time span (2005-2006) is believed to provide reasonably comparable data. Precipitation data cover a longer time span.
- Although the population in the county continues to grow, areas under cultivation vary year by year for the crops noted, with the variation often highly dependent upon the predicted availability of irrigation water.
- Livestock numbers also vary and are dependent upon a number of factors, including international marketing.

## GENERAL INFORMATION

The potential nitrogen loading evaluation for Owyhee County (Figure A-1) includes not only a countywide analysis but also a more area-specific analysis, where practical, of nitrogen sources. This dual approach is needed because while most of the county is desert and open range, the majority of the irrigated agriculture and confined animal feeding operations are present along the corridor between the Snake River and the foothills south of the river—a small portion of the county. The assumption, therefore, that nitrogen loading could occur along consistent, long ground water flow paths in the county is not reasonable. Nitrogen analysis, for Owyhee County, needs to be separated along hydrologic and land use perspectives.

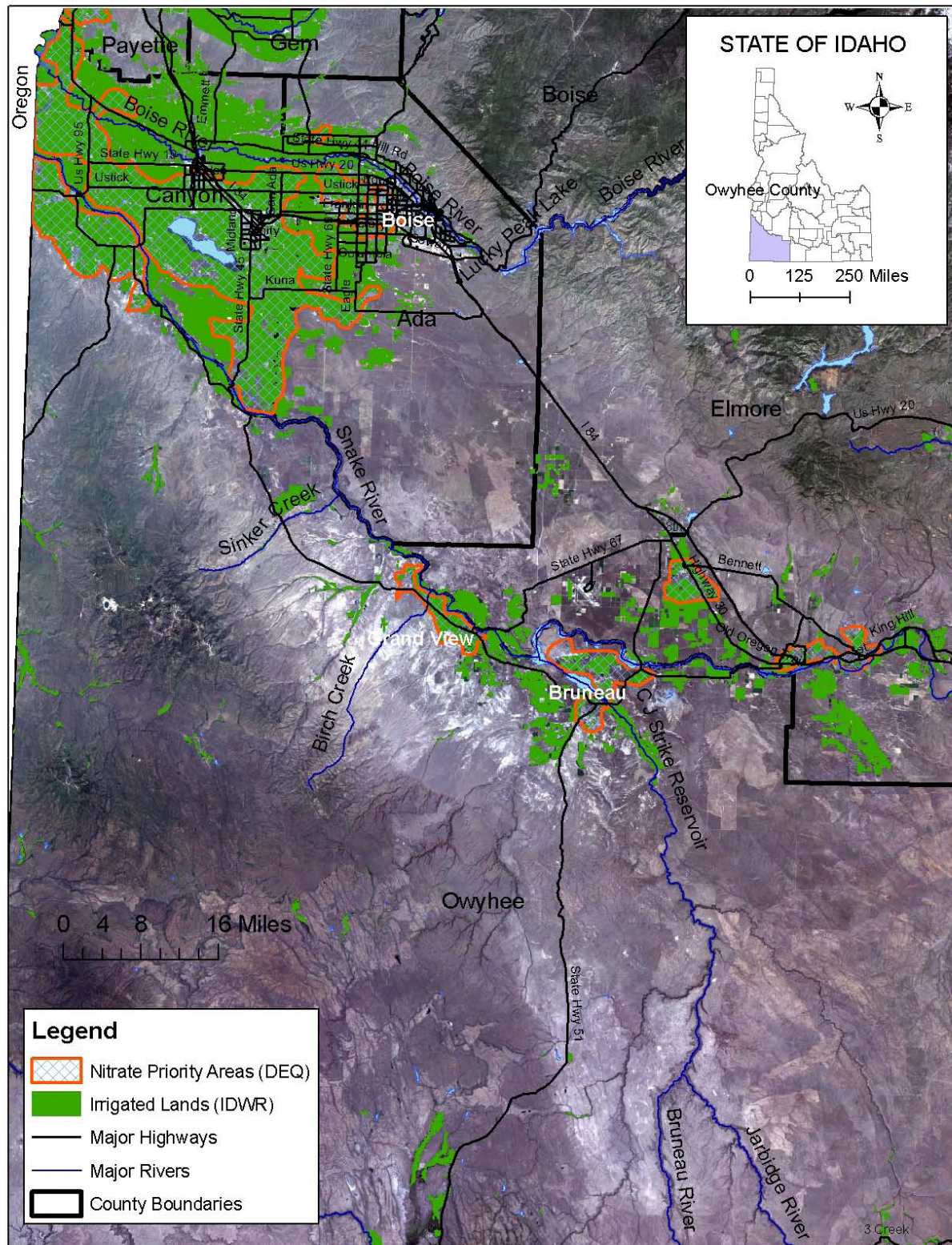


Figure A-1. Study area.

Looking from the hydrologic perspective, ground water in the northern part of the county, between the Snake River and the foothills, is expected to discharge to the Snake River. In the southern part of the county, it can be assumed that most ground water discharges to the forks of the Owyhee River. Nitrogen loading is estimated, where feasible, in the sub area lying east of Sinker Creek to the Owyhee County line, south of the Snake River to the approximate base of the foothills.

Looking at land ownership (Table A-1) and land use (Table A-2) reveals that these characteristics are distributed between private, state, and federal entities. Federal and state land ownership constitute large portions (82.5%) of the land area and, as expected, range land dominates land use (93.5%).

The currently available GIS database was queried to estimate the acreage of land in the Snake River corridor that is under irrigation. This query indicates 121,669 acres are under irrigation between the Oregon state line and the eastern Owyhee County line, along the Snake River corridor and within Owyhee County.

A refined query was made to determine the acreage under irrigation, in the area east of Sinker Creek to the eastern Owyhee County line that encompasses the nitrate priority areas near Grandview and Bruneau. The refined query resulted in an estimation of 62,547 acres, or about 51.4% of the irrigated acreage in Owyhee County in the Snake River corridor that lies east of Sinker Creek. This percentage will be used to estimate nitrogen loading in the vicinity of the nitrate priority areas.

**Table A-1. Distribution of land ownership.**

Owyhee County Owners/Land Use	Acres	Percent
Federal	3,727,155	75.8
State	327,472	6.7
Private	857,838	17.5
County	1,676	--
Municipal	35	--
<i>Total, all owners</i>	<i>4,914,176</i>	<i>100</i>

Source: County Profiles of Idaho,

<http://www.idahoworks.com/Default.aspx?tabid=451#countyProfiles>

**Table A-2. Distribution of land use.**

Owyhee County Land Use	Acres	Percent
Agriculture	191,700	3.9
Range	4,585,800	93.5
Other (barren, water, forest)	126,800	2.6
<i>Total</i>	<i>4,904,300</i>	<i>100</i>

Source: County Profiles of Idaho,

<http://www.idahoworks.com/Default.aspx?tabid=451#countyProfiles>

## FINDINGS

Estimated nitrogen loadings for each of the categories identified in the study objectives are presented in the following sections.

### **Nitrogen Loading from Crop Fertilization**

Estimates of nitrogen loading from crop fertilization (Table A-3) were compiled using acreage data and recommended fertilization rates. Important information regarding the sources used for these estimates includes the following:

- The amount of nitrogen that may have been applied to crops can be estimated by calculating the amount of nitrogen fertilizer that is recommended for application by using guidelines recommended by the University of Idaho (Tindall, 1991).
- Corn and oats are divided into two categories unlike the other crops. These crops are listed as grain and silage (corn) and grain and hay (oats) to allow the separation of the potential nitrogen loading because silage and hay are fed to livestock where the potential nitrogen loading also is estimated. The census only reports oats harvested as grain so it is assumed the balance is harvested as hay for livestock feed. This approach minimizes the double counting of nitrogen loading as fertilizer and again as animal waste. It is recognized that some portion of the locally grown grain will be used as livestock feed but the amount used in this manner is not known. Further complicating this aspect of the potential loading is the importation of grain and other protein supplements for livestock feed but this aspect of the evaluation is believed to be accounted for in the livestock waste estimates.
- The estimates of crops grown in the county are based on summaries provided by Idaho Agricultural Statistics Service (IASS) from information released for 2006. It should be noted that the acreages of some of the crops noted below change over time and this loading evaluation presents a snapshot for 2006.
- The values presented in Table A-3 are used for estimating the potential nitrogen load.
- Estimates of nitrogen fertilizer applied in other agricultural related enterprises are not readily quantifiable given the availability of data and variety of crops raised. Data for nurseries, greenhouses, floriculture, aquatic plants, mushrooms, flower seeds, vegetable seeds, and sod are limited. The types of fertilizers used and the applications rates are not known for these enterprises and are not considered.

**Table A-3. Nitrogen loading from crop fertilization on a countywide basis.**

<b>Crop</b>	<b>Crop Year</b>	<b>Acres Harvested (Acre)<sup>a</sup></b>	<b>Avg. County Yield (units/area)</b>	<b>U of I Guidelines (lbs/acre)</b>	<b>N - Total Required (lbs)</b>
Alfalfa	2005	47,200	5.85 tons/ac	0	0
Barley <sup>b</sup>	2005	1,800	88.2 bushels/ac	100	180,000
All Bean	2005	3,400	2,580 lbs/ac	30	102,000
Corn – grain	2005	7,100	178.9 bushels/ac	160	1,136,000
Corn - silage <sup>c</sup>	2005	7,700	25.5 tons/ac	110	847,000
Oats - grain <sup>b</sup>	2005	700	75.7 bushels/ac	100	70,000
Oats - hay <sup>b,c</sup>	2005	4,600	unknown	100	460,000
Potatoes	2005	3,600	456 cwt/ac <sup>d</sup>	105	378,000
Sugar Beets	2005	5,700	28.0 tons/ac	100	570,000
Wheat	2005	8,800	85.9 bushels/ac	100	880,000
<b>Total</b>					<b>3,316,000</b>

<sup>a</sup> U.S. Department of Agriculture, National Agricultural Statistics Service, 2005 Census of Agriculture - County Data.

<sup>b</sup> Fertilizer application rate for barley is assumed to be the same as for wheat.

<sup>c</sup> Corn raised for silage and oats raised for non-grain uses is assumed to be used locally for feed for livestock; nitrogen applied as fertilizer is not counted in this table because nitrogen also is accumulated in livestock waste in a later table.

<sup>d</sup> Cwt = hundred-weight.

Using the percentage of acreage that is irrigated in the vicinity of the nitrate priority areas allows the estimation of nitrogen loading that may occur in that area. Assuming the crop distribution is uniform across the Snake River corridor, 1,704,000 pounds of nitrogen are applied.

### **Nitrogen Loading from Plowing Down Legume Crops**

Nitrogen is released to the soil when legume crops are plowed down. This estimated nitrogen load is based on the plowing down of alfalfa and bean acreages and is shown in Table A-4.

Values shown in Table A-4 were estimated by multiplying the acreage for each crop by a factor of 60 pounds per acre for alfalfa and 40 pounds per acre for peas and beans (Tindall, 1991, Information Series 373). It is further assumed that one quarter of the alfalfa acreage is rotated out of production each year, so the potential nitrogen loading is based on one quarter of the potential total nitrogen load of alfalfa. Beans, in contrast, are an annual crop, so the total acreage is assumed to be plowed down each year. Total nitrogen loading is then as follows:

- Of the 47,200 acres of alfalfa in the county, about 11,800 acres are assumed to be plowed down each year. The estimated release of nitrogen is therefore 708,000 pounds, based on the 60 pounds per acre noted above.

- About 3,400 acres of beans are raised in the county; if the entire acreage is assumed to be plowed down, the estimated release of nitrogen is, therefore, about 136,000 pounds.

**Table A-4. Nitrogen loading from plowing down legume crops on a county-wide basis.**

<b>Crop</b>	<b>Acres<sup>a</sup></b>	<b>N contribution (lbs/acre)<sup>b</sup></b>	<b>Total Nitrogen (lbs)</b>
Alfalfa	11,800	60	708,000
Beans	3,400	40	136,000
<b>Total</b>			<b>844,000</b>

<sup>a</sup> U.S. Department of Agriculture, National Agricultural Statistics Service, 2005 Census of Agriculture - County Data.

<sup>b</sup> Nitrogen contribution is based on estimated provided in Tillman, 1991, Current Information Series No. 373.

Using the percentage of acreage that is irrigated in the vicinity of the nitrate priority areas allows the estimation of nitrogen loading that may occur in that area. Assuming the crop distribution is uniform across the Snake River corridor, 434,000 pounds of nitrogen are applied.

### **Nitrogen Loading from Domestic and Urban Sources**

Domestic wastewater also contributes to nitrogen loading as shown in Table A-5. Notes regarding the data used in the estimate include the following:

- The current county profile estimates the distribution of population for the year 2005. The population of the county in 2005 was estimated to be 11,073; of which 8,220 are attributed to rural areas. The population distribution between rural and urban residents is based on information (74.2% rural and 25.8% urban) presented in the county profile for the year 2000 (County Profiles of Idaho, 2006).
- The U.S. Environmental Protection Agency (2002) compiled data from various studies of residential wastewater flows and found the average flow rate is 68.6 gal/person/day. The estimated rate of nitrogen loading that can occur to ground water has been updated to reflect studies of wastewater systems that include Total Kjeldahl Nitrogen (TKN) and nitrate as effluent from the septic tank and soil water at 1.97 ft (0.6 meters) and 3.94 ft (1.2 meters) depths. The TKN concentration decreases with depth, and the nitrate concentration increases with depth, due to conversion processes that occur in situ. The nitrate concentration at 3.94 ft depth averaged 13.0 mg/L in the studies, and this value is assumed to percolate to ground water in the aquifer with minimal changes.
- It should be noted that nitrogen from domestic waste is applied through drainfields below the crop root zone; little or no nitrogen is removed by plants, and it is assumed to be available to migrate to ground water.

**Table A-5. Nitrogen loading from domestic and urban sources on a countywide basis.**

	<b>Area Population</b>	<b>Human Nitrogen Contribution (lb/gal)<sup>a</sup></b>	<b>Individual Nitrogen Contribution (lb/day)<sup>c</sup></b>	<b>Total Human N Contribution (lbs/day)<sup>d</sup></b>	<b>Total Human N Contribution (lbs/yr)</b>
Rural Owyhee County <sup>b</sup>	8,220 (68.6 gallons per day per person)	0.0001085 (13 mg/L)	0.007	61	22,332
Urban Owyhee County	2,860 (68.6 gallons per day per person)	0.000025 (3 mg/L limit)	0.002	5	1,790
<b>Total</b>					<b>24,122</b>
<sup>a</sup> Human nitrogen contribution is 13.0 mg/L (EPA 2002) for residences					
<sup>b</sup> For the rural population, multiply the Human Nitrogen Contribution by 68.6 gallons per day; estimated @ 74.2% of county population for 2005; for the schools, there is no individual value.					
<sup>c</sup> For the urban population, assumed 25.8% of county population, multiply the daily flow by the 3 mg/L limit.					

The total nitrogen loading from rural and urban sources is the sum of the 22,332 pounds and the 1,790 pounds shown in Table A-5, which is 24,122 pounds. The value for urban sources is very conservative because the estimate assumes all residents in the towns use septic systems which is not the case.

An estimate of the nitrogen loading from domestic sources in the vicinity of the nitrate priority areas is not practical with the data currently available. Therefore, the total nitrogen load will be compared to other sources near the nitrate priority areas.

### **Nitrogen Loading from Livestock/Animal Waste**

The nitrogen contribution from livestock in the county (Table A-6) is based on U.S. Department of Agriculture census data for 2005 (head count as of January 1, 2006) and guidelines for estimating the production of nitrogen from animal wastes:

- The estimates for nitrogen in livestock waste assume the waste is applied directly to the land, except where the livestock would normally be confined and the wastes stored before application.
- In the case where wastes are stored before application to the land, the residual nitrogen is estimated using guidelines developed by the university extension services. These guidelines account for losses of nitrogen during storage (30%) and losses that occur during handling and spreading (20%).

- Data are not available at this time for other livestock. This evaluation uses data for cattle and sheep (including lambs) only. Cattle have been the largest contributor to nitrogen loading in previous evaluations and the omission of other stock are not believed to cause a significant difference in the proportional distribution of nitrogen loading estimates.

**Table A-6. Nitrogen loading from livestock/animal waste on a county-wide basis.**

<b>Livestock Type</b>	<b># of Animals<sup>a</sup></b>	<b>Estimated Nitrogen (lbs/animal/yr)</b>	<b>Total Nitrogen (lbs/yr)</b>
Dairy <sup>b</sup>	17,000	129	2,193,000
Beef <sup>b</sup>	36,500	55	2,007,500
Other cattle <sup>b,c</sup>	85,000	55	4,675,000
Subtotal			8,875,500
Sheep	4,700	9.2	43,240
Subtotal			43,240
Total			8,918,740

<sup>a</sup> Source is U.S. Department of Agriculture, National Agricultural Statistics Service, 2006 Census of Agriculture – County Data (head count by January 1, 2006).  
<sup>b</sup> Animals are assumed to be confined and waste collected and stored before application.  
<sup>c</sup> "Other cattle" is heifers, calves, steers, and bulls.

Nitrogen loading for cattle (beef and dairy) in confined animal feeding operations (CAFOs) within one mile of the nitrate priority areas can be estimated using current data, Table A-7, available in GIS developed by the Idaho Department of Agriculture. The GIS data indicates two dairies are located within the nitrate priority areas for a total of about 340 head. One feedlot is located within 1 mile of the nitrate priority areas with an estimated count of 7,000 head.

**Table A-7. Nitrogen loading from livestock/animal waste on a nitrate priority area basis.**

<b>Livestock Type</b>	<b># of Animals<sup>a</sup></b>	<b>Estimated Nitrogen (lbs/animal/yr)</b>	<b>Total Nitrogen (lbs/yr)</b>
Dairy <sup>b</sup>	340	129	43,860
Beef <sup>b,c</sup>	7,000	55	385,000
Total			428,860

<sup>a</sup> Source is U.S. Department of Agriculture, National Agricultural Statistics Service, 2006 Census of Agriculture – County Data (head count by January 1, 2006).  
<sup>b</sup> Animals are assumed to be confined and waste collected and stored before application.  
<sup>c</sup> Beef cattle is assumed to include calves, heifers, and bulls.

### Nitrogen Loading from Industrial Sources

Nitrogen is applied to the ground at one wastewater land application permit (WLAP) site in Owyhee County (Table A-8). The one site was predicted to apply 250 lbs/acre in 2005 based on data available for 2004. The total nitrogen applied is presented for the reported

812 acres of acreage that is cropped for alfalfa and wheat. (It should be noted that WLAP facilities routinely report the amount of wastewater and nutrients applied to their land application sites and the amount of nutrients removed by cropping the acreage. The net balance for nitrogen typically is negative in that the crops remove more nitrogen than is applied to the land.)

**Table A-8. Nitrogen loading from industrial sources on a county-wide basis.**

	<b>Acreage (ac)</b>	<b>Total Nitrogen Applied (lbs/year)</b>
Food By-product Management, LLC <sup>a</sup>	812 <sup>b</sup>	203,145
There are no other WLAP sites reported to be applying nitrogen	0	0
<b>Total</b>		<b>203,145</b>
<i><sup>a</sup> Projection for 2005 is based on 2004 application volumes for Sorrento Lactalis and Meadow Gold Dairies; Permit LA-000191-01</i>		

There are no industrial sources of nitrogen located within 1 mile of the nitrate priority areas. The facility noted above is located downriver from the priority areas.

### **Nitrogen Loading from Precipitation**

Total nitrogen deposited annually by precipitation can be estimated for the county using the same methods employed by Rupert (1996) for the upper Snake River Basin. The following equation defines the approach for developing this estimate:

**Equation 1.** Error! Objects cannot be created from editing field codes.

Where:

B = total nitrogen input from precipitation (kg),

E = total nitrogen concentration in precipitation (mg/L),

Q = annual rainfall (m),

I = land area within the county (m<sup>2</sup>), and

D = dry deposition constant (unitless).

Values used for this evaluation are as follows:

- Maupin (1995) estimated the total nitrogen in precipitation (E) for the upper Snake River Basin to range from 0.18 to 0.27 mg/L. The midrange concentration (0.23 mg/L) total nitrogen is used to calculate the nitrogen contribution from precipitation for this evaluation.
- Average annual precipitation (Q) is 6.91 inches (0.176 m) at Grand View based on records from 1933 to 2005 and 7.44 inches (0.189 m) at Bruneau based on records from 1962 to 2005 (Western Regional Climate Center). The average precipitation value for Bruneau will be used in this analysis because the shorter, more recent record

is deemed to be more appropriate for this estimate and is nearest the nitrate priority area. Much of the county lies at higher elevations and receives more precipitation such as Silver City (21.61 inches/year, record from 1978 through 2005).

- Owyhee County covers (I) 4,906,220 acres (1.985 E+10 m<sup>2</sup>) (State of Idaho, 2005)
- Rupert (1996) used a dry deposition constant (D) of 1.444 to convert the wet deposition value to total nitrogen supplied by wet and dry deposition.

Applying these values yields the following for the county:

$$B = \{(0.23 \text{ mg/L}) (0.189 \text{ m}) (1.985\text{E}+09\text{m}^2) (1.444) (1,000 \text{ L/m}^3)\} \div (1\text{E}+06 \text{ mg/kg})$$

$$B = 125,000 \text{ kg}$$

$$B = 276,000 \text{ lbs}$$

Nitrogen loading from precipitation would be about 2.9 times larger if the average precipitation rate at Silver City is considered representative of the whole county. Total nitrogen loading would be about 802,000 lbs/year. This greater annual loading is not considered representative for the corridor along the Snake River.

Nitrogen loading for the two priority areas can be estimated using the combined acreage which is 38,242 (Grand View = 13,987 acres and Bruneau = 24,255 acres). Applying these values yields the following for the priority areas noted:

$$B = \{(0.23 \text{ mg/L}) (0.189 \text{ m}) (1.548\text{E}+08\text{m}^2) (1.444) (1,000 \text{ L/m}^3)\} \div (1\text{E}+06 \text{ mg/kg})$$

$$B = 9,720 \text{ kg}$$

$$B = 21,400 \text{ lbs}$$

### Total Estimated Nitrogen Loading

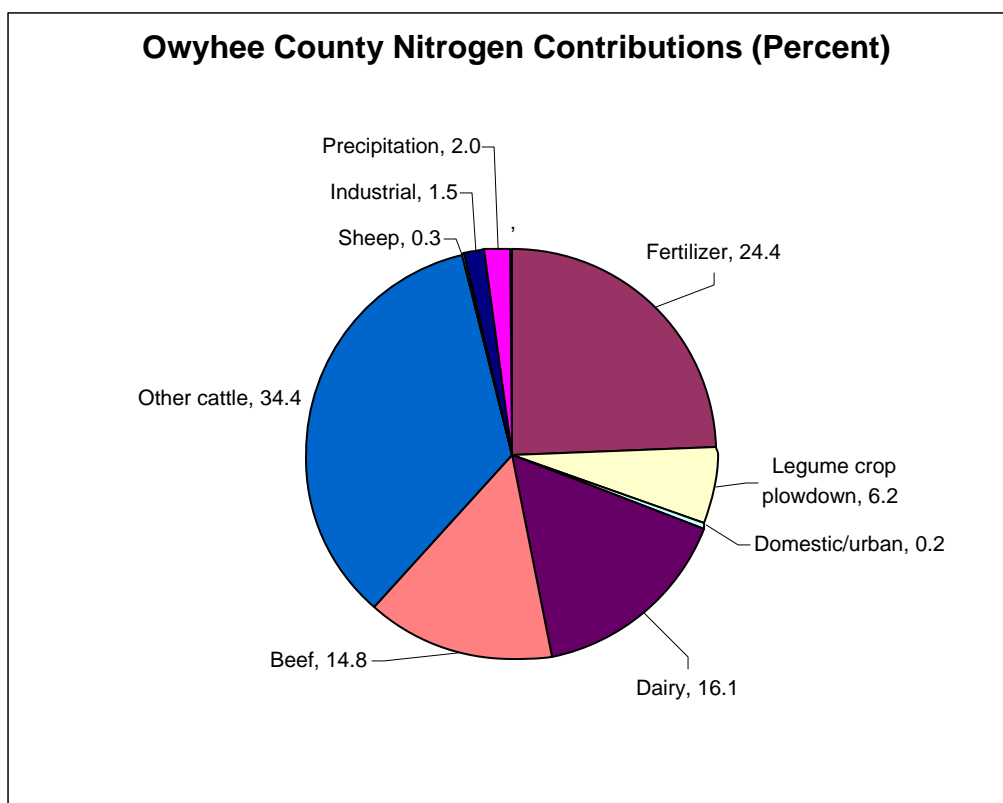
The total nitrogen loading that potentially is applied to the land surface in Owyhee County (Table A-9) can be estimated by combining the subtotals of the six<sup>2</sup> categories of sources described above. Figure A-2 presents the same information graphically.

**Table A-9. Total estimate nitrogen loading from all categories of sources.**

Source	Nitrogen Contribution (lbs)	Percent Contribution
Fertilizer	3,316,000	24.4
Legume crop plowdown	844,000	6.2
Domestic/urban	24,122	0.2
Dairy	2,193,000	16.1
Beef	2,007,500	14.8
Other cattle	4,675,000	34.4
Sheep	43,240	0.3
Industrial	203,145	1.5
Precipitation	276,000	2.0
Total	13,582,007	100

*Note: "Other cattle" is heifers, calves, steers, and bulls.*

<sup>2</sup> Because of the relative magnitude of the nitrogen loading contributed by animal waste, this category is presented using data from four subcategories: dairy, beef, other cattle, and sheep which includes lambs.



**Figure A-2. Estimated nitrogen loading for Owyhee County, by source.**

The total nitrogen loading that potentially is applied to the land surface in the nitrate priority areas (Table A-10) can be estimated by combining the subtotals of the six categories of sources described above. Figure A-3 presents the same information graphically.

**Table A-10. Total nitrogen loading potentially applied to land surface in nitrate priority areas.**

Source	Nitrogen Contribution (lbs)	Percent Contribution
Fertilizer	1,704,000	65.2
Legume crop plowdown	434,000	16.6
Domestic/urban	24,122	0.9
Dairy & beef	428,860	16.4
Industrial	0	0.0
Precipitation	21,400	0.8
Total	2,612,382	100

*Note: Beef includes heifers, calves, steers, and bulls.*

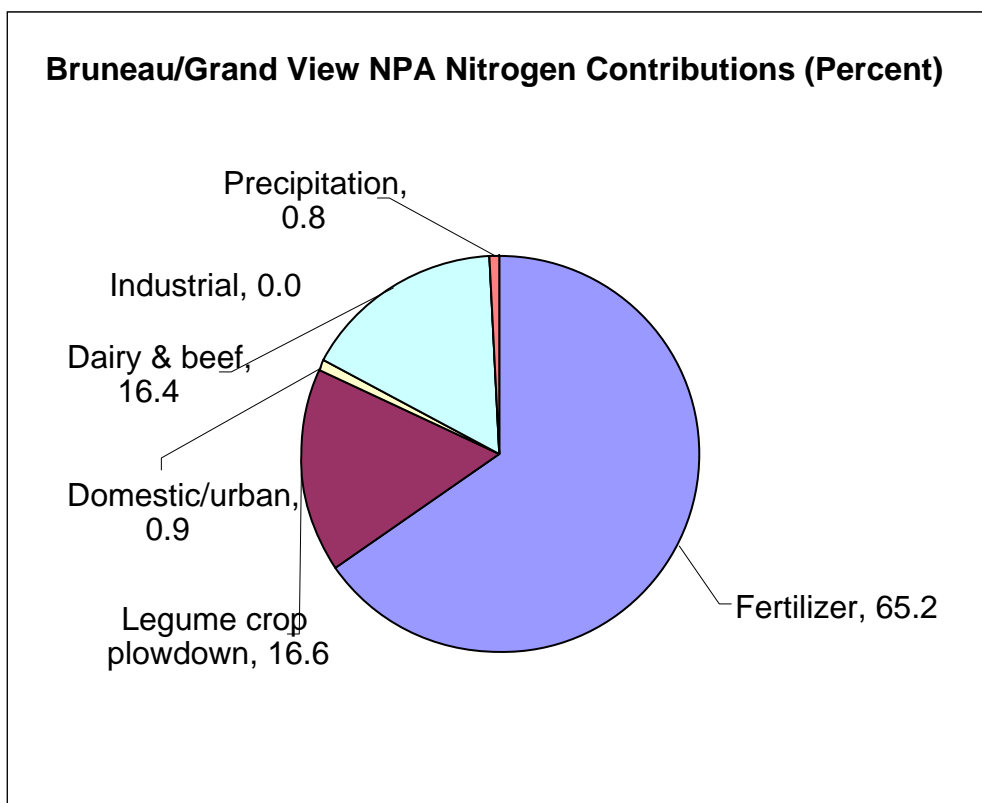


Figure A-3. Estimated nitrogen loading for Bruneau/Grand View Nitrate Priority Areas, by source.

## SUMMARY AND CONCLUSIONS

It is apparent from comparing Tables A-9 and A-10 that the countywide estimate of nitrogen loading provides a skewed view of the potential sources of nitrogen for the nitrate priority areas. Cattle provide 65.3% of the potential nitrogen loading in the countywide estimate (Table A-9) whereas cattle only provide 16.4% of the potential nitrogen loading in the vicinity of the priority areas (Table A-10).

The largest potential source of nitrogen that could impact ground water in the Bruneau/Grand View Nitrate Priority Areas is nitrogen from fertilizer applications (65.2%). The second largest potential source of nitrogen is from legume crops (16.6%) and from dairy and cattle operations (16.4%). The remaining 1.8% of the potential nitrogen sources can be attributed to domestic/urban waste, and precipitation sources.

This does not mean the results of this evaluation should be interpreted to indicate that localized problems cannot occur from the smaller sources of nitrogen. What it does mean is that the bulk of the potential nitrogen loading that can occur to ground water in the county can be expected to come from farming and livestock operations within the county.

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